

CLAIMS

Amend the claims as follows.

1. (Currently amended) A signal transmission circuit comprising:
 - a first signal transmission path for receiving a first input signal, and for outputting a corresponding first output signal which is delayed by a first delay time from the first input signal;
 - a second signal transmission path for receiving a second input signal distinct from the first input signal, and for outputting a corresponding second temporary signal which is delayed by a second delay time from the second input signal;
 - an auxiliary signal transmission path for receiving the first input signal, and for outputting a first temporary signal having a third delay;
 - a master delay unit for generating a master output signal having a master delay;
 - a control unit for generating an adjustment control signal responsive to the first output signal and the master output signal; and
 - a slave delay unit for generating a second output signal responsive to the adjustment control signal.
2. (Original) The circuit of claim 1, wherein the auxiliary signal transmission path is a replica of the second signal transmission path.
3. (Original) The circuit of claim 1, wherein the adjustment control signal is such that the first delay time substantially equals the second delay time plus the internal delay time.
4. (Currently amended) The circuit of claim 1, wherein the ~~controllable delay control~~ unit is implemented by a voltage controlled delay.
5. (Currently amended) The circuit of claim 1, wherein the ~~controllable delay control~~ unit comprises:
 - a plurality of delay branches; and
 - a multiplexer for selecting, responsive to the adjustment control signal, one of the delay branches.

6. (Currently amended) A signal transmission circuit comprising:

- a first signal transmission path for receiving a first input signal, and for outputting a corresponding first output signal which is delayed by a first delay time from the first input signal;
- a second signal transmission path for receiving a second input signal distinct from the first input signal, and for outputting a corresponding second temporary signal which is delayed by a second delay time from the second input signal;
- an auxiliary signal transmission path for receiving the first input signal, and for outputting a first temporary signal having a third delay associated with the second delay time;
- a controlling unit for comparing the first output signal and the first temporary signal to generate an adjustment control signal; and
- a controllable delay unit for receiving the adjustment control signal to adjust an internal delay time thereof, and for receiving the second temporary signal for outputting a second output signal which is delayed by the internal delay time from the second temporary signal;

wherein the controlling unit comprises:

- a master variable delay unit adapted to receive the first temporary signal, and having a master internal delay which is controlled by the adjustment control signal; and
- a control unit for receiving an output signal of the master variable delay unit and the first output signal to generate the adjustment control signal.

7. (Original) The circuit of claim 6, wherein

- the master variable delay unit and the controllable delay unit are made identically, and
- the master internal delay is controlled to substantially equal the internal delay of the controllable delay unit.

8. (Original) The circuit of claim 6, wherein the master variable delay unit comprises:

- a plurality of delay branches; and
- a multiplexer for selecting, responsive to the adjustment control signal, one of the delay branches.

9. (Original) The circuit of claim 6, wherein the control unit comprises:
a phase detector adapted to detect a phase difference between the first output signal and the output signal of the master variable delay unit, and to generate a detect signal responsive to the phase difference.

10. (Original) The circuit of claim 9, wherein the master variable delay unit comprises:
a plurality of delay branches; and
a multiplexer for selecting, responsive to the adjustment control signal, one of the delay branches.

11. (Original) The circuit of claim 9, wherein
the control unit further includes an electric charge pump unit for generating the adjustment control signal responsive to the detect signal, and
the master variable delay unit and the controllable delay unit are implemented by voltage controlled variable delay units.

12. (Currently amended) ~~The A signal transmission circuit of claim 9,~~
comprising:
a first signal transmission path for receiving a first input signal, and for outputting a corresponding first output signal which is delayed by a first delay time from the first input signal;
a second signal transmission path for receiving a second input signal, and for outputting a corresponding second temporary signal which is delayed by a second delay time from the second input signal;
an auxiliary signal transmission path for receiving the first input signal, and for outputting a first temporary signal having a third delay associated with the second delay time;
a controlling unit for comparing the first output signal and the first temporary signal to generate an adjustment control signal; and
a controllable delay unit for receiving the adjustment control signal to adjust an internal delay time thereof, and for receiving the second temporary signal for outputting a second output signal which is delayed by the internal delay time from the second temporary signal;
wherein the controlling unit includes:

a master variable delay unit adapted to receive the first temporary signal, and having a master internal delay which is controlled by the adjustment control signal; and
a control unit for receiving an output signal of the master variable delay unit and the first output signal to generate the adjustment control signal; and
wherein the control unit includes:
a phase detector adapted to detect a phase difference between the first output signal and the output signal of the master variable delay unit, and to generate a detect signal responsive to the phase difference; and
wherein the control unit further includes a register for generating the adjustment control signal responsive to the detect signal[.]; and
wherein the master variable delay unit and the controllable delay unit are implemented by code controlled variable delay units.

13. (Currently amended) The circuit of claim 1, wherein
the ~~controlling control~~ unit is adapted to generate the adjustment control signal according to a phase difference between the first output signal and the first temporary signal.

14. (Currently amended) A signal transmission circuit comprising:
a first signal transmission path for receiving a first input signal, and for outputting a corresponding first output signal which is delayed by a first delay time from the first input signal;
a second signal transmission path for receiving a second input signal distinct from the first input signal, and for outputting a corresponding second temporary signal which is delayed by a second delay time from the second input signal;
an auxiliary signal transmission path for receiving the first input signal, and for outputting a first temporary signal having a third delay associated with the second delay time;
a controlling unit for comparing the first output signal and the first temporary signal to generate an adjustment control signal; and
a controllable delay unit for receiving the adjustment control signal to adjust an internal delay time thereof, and for receiving the second temporary signal for outputting a second output signal which is delayed by the internal delay time from the second temporary signal;
wherein the controlling unit is adapted to generate the adjustment control signal according to a phase difference between the first output signal and the first temporary signal,

wherein the adjustment control signal has a voltage level proportional to the phase difference according to a first proportionality constant, and

wherein the internal ~~phase-delay~~ time has a magnitude proportional to the voltage level of the adjustment control signal according to a second proportionality constant.

15. (Original) The circuit of claim 14, wherein
the product of the first proportionality constant and the second proportionality constant substantially equals one.

16. (Previously presented) A signal transmission circuit comprising:
a first signal transmission path for receiving a first input signal, and for outputting a corresponding first output signal which is delayed by a first delay time from the first input signal;
a second signal transmission path for receiving a second input signal, and for outputting a corresponding second temporary signal which is delayed by a second delay time from the second input signal;
an auxiliary signal transmission path for receiving the first input signal, and for outputting a first temporary signal having a third delay associated with the second delay time;
a controlling unit for comparing the first output signal and the first temporary signal to generate an adjustment control signal; and
a controllable delay unit for receiving the adjustment control signal to adjust an internal delay time thereof, and for receiving the second temporary signal for outputting a second output signal which is delayed by the internal delay time from the second temporary signal;
wherein the controlling unit is adapted to generate the adjustment control signal according to a phase difference between the first output signal and the first temporary signal,
wherein the controlling unit comprises:
a plurality of delay elements, each of which delays the first temporary signal by a predetermined delay time and outputs a delayed output signal;
phase detectors corresponding the plurality of delay elements, each of the phase detectors for outputting phase comparison signals by comparing the phase of one signal of the output signals of the delay elements with the phase of the first signal transmission path;
and

an encoder for receiving each of the phase comparison signals output from the phase detectors and generating the control code.

17. (Original) A data latch circuit of a semiconductor device comprising:
- a reference signal transmission path for delaying a reference signal by a predetermined first delay time and outputting a delayed reference signal;
 - first through N-th data transmission paths for delaying first through N-th input data by a predetermined second delay time, respectively, and outputting delayed data of each of the input data;
 - an auxiliary signal transmission path having delay characteristics identical with those of the first data transmission path, for receiving the reference signal;
 - a master variable delay unit serially-connected to the auxiliary signal transmission path, and having a delay time which is controlled by a control signal;
 - first through N-th slave variable delay units serially-connected to the first through N-th data transmission paths, respectively, and having delay times which are controlled by the control signal;
 - a control unit for receiving an output signal of the master variable delay unit and an output signal of the reference signal transmission path, and for generating the control signal in response thereto; and
 - first through N-th data latch means for receiving output signals of the first through N-th slave variable delay units, respectively, responsive to the delayed reference signal.

18. (Original) The circuit of claim 17, wherein the control unit comprises:
- a phase detector adapted to detect a phase difference between the output signal of the reference signal transmission path and the output signal of the master variable delay unit, and to generate a detect signal responsive to the phase difference.

19. (Original) The circuit of claim 18, wherein
- the control unit further includes an electric charge pump unit for generating the control signal responsive to the detect signal, and
 - the master variable delay unit and the first through N-th slave variable delay units are voltage controlled variable delay units.

20. (Original) The circuit of claim 18, wherein
the control unit further includes a register for generating the control signal responsive
to the detect signal, and
the master variable delay unit and the first through N-th slave variable delay units are
digital code controlled variable delay units.

21. (Original) The circuit of claim 18, wherein
the first through N-th data latch means and the phase detector are flip-flops.

22. (Currently amended) A signal transmission method implemented in a signal
transmission circuit having first and second signal transmission paths, each of which has
different delay characteristics, the method comprising the steps of:

additionally including an auxiliary signal transmission path having delay
characteristics identical with the second signal transmission path and a master variable delay
unit serially-connected to the auxiliary signal transmission path;

additionally including a slave variable delay unit serially-connected to the second
signal transmission path;

inputting a first input signal to the first signal transmission path and the auxiliary
signal transmission path, and inputting a second input signal distinct from the first input
signal to the second signal transmission path;

generating a control signal corresponding to the phase difference obtained by
comparing the phase of an output signal of the first signal transmission path with the phase of
an output signal of the master variable delay unit;

controlling the delay time of the master variable delay unit by applying the control
signal to the master variable delay unit; and

controlling the delay time of the slave variable delay unit to be identical with the
delay time of the master variable delay unit by applying the control signal to the slave
variable delay unit.

23. (Currently amended) A signal transmission circuit comprising:
a first signal transmission path for receiving a first input signal, and for outputting a
corresponding first output signal which is delayed by a first delay time from the first input
signal;

a second signal transmission path for receiving a second input signal distinct from the first input signal, and for outputting a corresponding second temporary signal which is delayed by a second delay time from the second input signal;

an auxiliary signal transmission path which is a replica of the second signal transmission path, for receiving the first input signal, and for outputting a first temporary signal which is delayed by the second delay time from the first input signal;

a controllable delay unit for receiving an adjustment control signal to adjust an internal delay time thereof, and for receiving the second temporary signal for outputting a second output signal which is delayed by the internal delay time from the second temporary signal;

a master delay unit for generating a master delay signal responsive to the first temporary signal; and

a control unit for generating the adjustment control signal responsive to the first temporary signal and the first output signal.

24. (Previously presented) The signal transmission circuit of claim 23 wherein the sum of the second delay time and the internal delay time is controlled to substantially equal the first delay time.

25. (Currently amended) A signal transmission circuit comprising:
a first signal transmission path for receiving a first input signal, and for outputting a corresponding first output signal which is delayed by a first delay time from the first input signal;
a second signal transmission path for receiving a second input signal distinct from the first input signal, and for outputting a corresponding second temporary signal which is delayed by a second delay time from the second input signal;
an auxiliary signal transmission path which is a replica of the second signal transmission path, for receiving the first input signal, and for outputting a first temporary signal which is delayed by the second delay time from the first input signal;
a controlling unit comprising a master variable delay unit for receiving the first temporary signal and an adjustment control signal, and a control unit for comparing the output signal of the master variable delay unit and the first output signal, and generating the adjustment control signal; and

a slave variable delay unit for receiving the adjustment control signal to adjust an internal delay time thereof, and for receiving the second temporary signal for outputting a second output signal which is delayed by the internal delay time from the second temporary signal,

wherein the sum of the second delay time and the internal delay time is controlled to substantially equal the first delay time.

26. (Previously presented) A signal transmission circuit comprising:

a clock signal transmission path for receiving a clock input signal, and for outputting a corresponding clock output signal which is delayed by a first delay time from the clock input signal;

at least one data signal transmission path for receiving a data input signal, and for outputting a corresponding data temporary signal which is delayed by a second delay time from the data input signal;

an auxiliary signal transmission path which is a replica of the at least one data signal transmission path, for receiving the clock input signal, and for outputting a clock temporary signal which is delayed by the second delay time from the clock input signal;

a master variable delay unit to generate a master output signal responsive to a control signal and the clock signal delayed by the first delay time;

at least one slave delay unit corresponding the at least one data transmission path adapted to operate responsive to the control signal;

a phase detector for generating a phase signal to indicate a phase difference between the clock signal delayed by the first delay time and the master output signal; and

a control unit to generate the control signal responsive to the phase signal.

27. (Original) A signal transmission circuit comprising:

a clock signal transmission path for receiving a clock input signal, and for outputting a corresponding clock output signal which is delayed by a first delay time from the clock input signal;

a data signal transmission path for receiving a data input signal, and for outputting a corresponding data temporary signal which is delayed by a second delay time from the data input signal;

an auxiliary signal transmission path which is a replica of the data signal transmission path, for receiving the clock input signal, and for outputting a clock temporary signal which is delayed by the second delay time from the clock input signal;

a controlling unit comprising a master variable delay unit for receiving the clock temporary signal and an adjustment control signal, and a control unit for comparing the output signal of the master variable delay unit and the clock output signal, and generating the adjustment control signal; and

a slave variable delay unit for receiving the adjustment control signal to adjust an internal delay time thereof, and for receiving the data temporary signal for outputting a data output signal which is delayed by the internal delay time from the data temporary signal.

28. (Original) A signal transmission circuit comprising:

a clock signal transmission path for receiving a clock input signal, and for outputting a corresponding clock output signal which is delayed by a first delay time from the clock input signal;

a data signal transmission path for receiving a data input signal, and for outputting a corresponding data temporary signal which is delayed by a second delay time from the data input signal;

an auxiliary signal transmission path which is a replica of the data signal transmission path, for receiving the clock input signal, and for outputting a clock temporary signal which is delayed by the second delay time from the clock input signal;

a controlling unit comprising a first voltage controlled variable delay unit for receiving the clock temporary signal and an adjustment control signal, and a phase detector for detecting a phase difference between the output signal of the first voltage controlled variable delay unit and the clock output signal and generating a detect signal responsive to the phase difference, and an electric charge pump unit for generating the adjustment control signal responsive to the detect signal; and

a second voltage controlled variable delay unit for receiving the adjustment control signal to adjust an internal delay time thereof, and for receiving the data temporary signal for outputting a data output signal which is delayed by the internal delay time from the data temporary signal,

wherein the sum of the second delay time and the internal delay time is substantially controlled to equal the first delay time.

29. (Original) A signal transmission circuit comprising:

a clock signal transmission path for receiving a clock input signal, and for outputting a corresponding clock output signal which is delayed by a first delay time from the clock input signal;

a data signal transmission path for receiving a data input signal, and for outputting a corresponding data temporary signal which is delayed by a second delay time from the data input signal;

an auxiliary signal transmission path which is a replica of the data signal transmission path, for receiving the clock input signal, and for outputting a clock temporary signal which is delayed by the second delay time from the clock input signal;

a controlling unit comprising a first digital code controlled variable delay unit for receiving the clock temporary signal and a digital code signal, and a phase detector for detecting a phase difference between the output signal of the first digital code controlled variable delay unit and the clock output signal and generating a detect signal responsive to the phase difference, and a register for generating the digital code signal responsive to the detect signal; and

a second digital code controlled variable delay unit for receiving the digital code signal to adjust an internal delay time thereof, and for receiving the data temporary signal for outputting a data output signal which is delayed by the internal delay time from the data temporary signal,

wherein the sum of the second delay time and the internal delay time is controlled to substantially equal the first delay time.